ANT180-L Series Stage
User's Manual

P/N: EDS153 (Revision 1.02.00)

Dedicated to the Science of Motion
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Chapter 1: Overview

The ANT180-L series linear mechanical bearing positioning stages are designed to provide excellent performance and high load capacity over long travel ranges. The compact and powerful design compliments outstanding accuracy, repeatability, resolution, and stability. ANT180-L stages are offered in two accuracy grades and can be ordered as multi-axis systems.

This manual describes Aerotech's ANT180-L series positioning stage. Figure 1-1 shows a typical ANT180-L linear positioning stage.

This chapter introduces standard and optional features of the ANT180-L, explains the model numbering system, and gives general safety precautions.

Figure 1-1: ANT180-L Linear Positioning Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

1.1. Standard Features

The ANT180-L series stages incorporate linear anti-creep cross-roller bearings, a linear motor, and a non-contact linear encoder. These features allow the ANT180-L series stages to provide excellent performance in speed, accuracy, resolution, repeatability, and reliability.

The linear cross-roller bearings offer excellent stiffness, high load carrying capabilities, and minimal friction for smooth movement. The cross roller bearings also incorporate a system to prevent cage creep and keep the rollers centered in the bearing rails.

The ANT180-L series stages are driven by a linear motor. The brushless linear motor uses an ironless forcer, which means there is zero cogging and there are no attractive forces – resulting in unsurpassed smoothness of motion. A moving magnet track design eliminates the need for cable management, improving long-term reliability.

ANT180-L stages have four standard travel lengths: 160 mm, 210 mm, 260 mm, and 360 mm.

All ANT180-L stages contain integrated 25-pin D feedback and hi-power D motor connectors. This allows for fast and simple connections and freedom from flying leads exiting the stage.

1.1.1. Optional Features

ANT180-L stages can be ordered as a single axis or as part of a standard multi-axis configuration. An optional customer air line can also be added to a multi-axis system which delivers a 6 mm hose to the table-top of the top axis. Cable management and connectorization for a Z or Theta axis is also a standard option.

Aerotech offers three encoder options for the ANT180-L series. The LTAS option selects a standard accuracy amplified sine output encoder with a 20 µm signal period. The LTX50 option selects a standard accuracy 0.1 micron line driver output encoder with a 20 µm signal period. The LNAS option selects a high accuracy amplified sine output encoder with a 4 µm signal period.

For vacuum applications, two vacuum preparation options are available; one compatible with low vacuum environments (down to 10^{-3} torr) and the other for high vacuum (10^{-3} to 10^{-6} torr). Contact Aerotech for more details on optional features and configurations.

1.1.2. Model Numbers

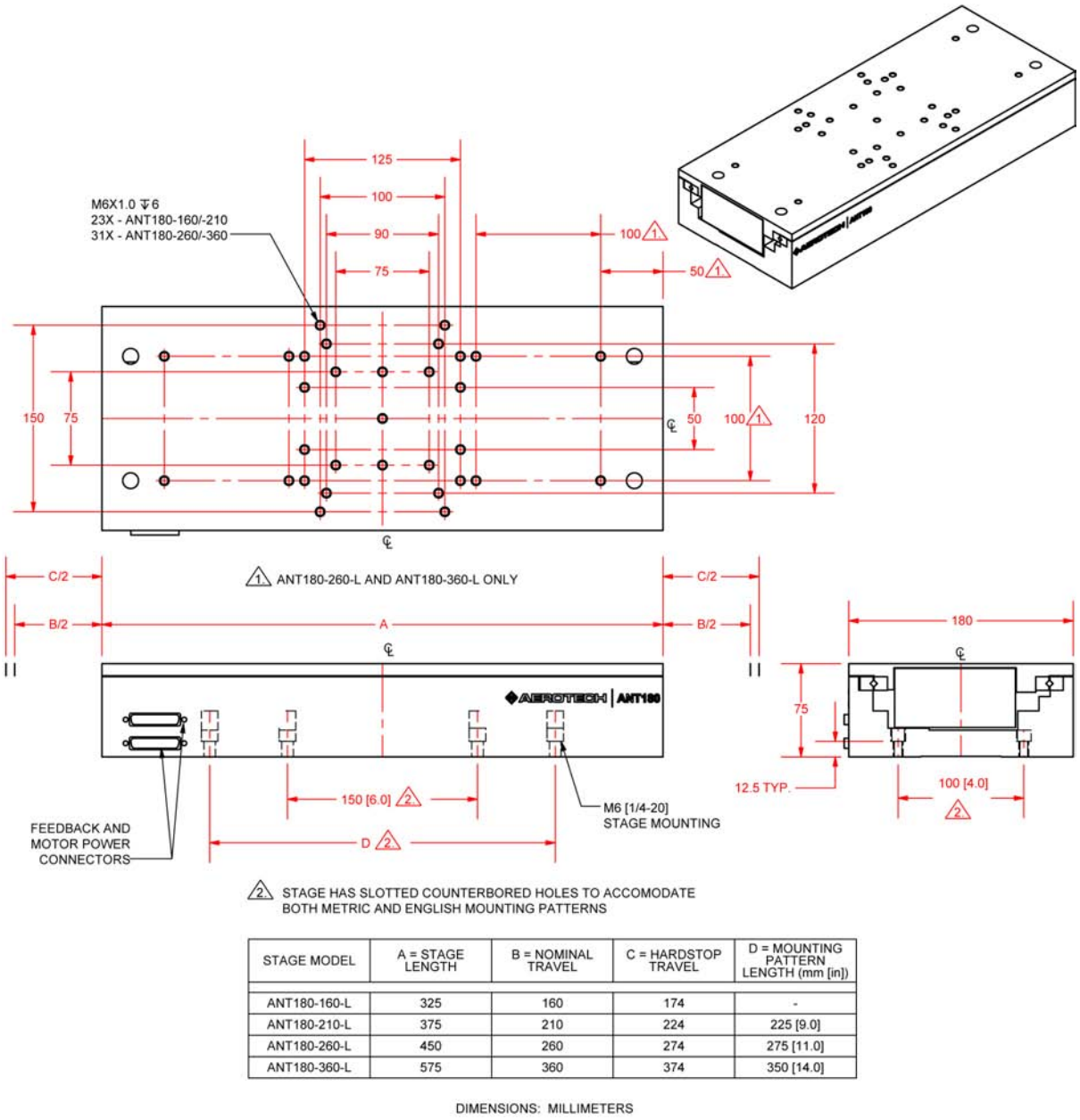
Stage model number example: ANT180-210-L-LTX50-XY-AIR

The tables below list the available options in the order they appear in the example above. Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

Table 1-1: Model Numbering System for ANT180-L Stages

ANT180-L Series Linear Motor Stage	
ANT180-160-L	160 mm travel stage with linear motor and integral limits
ANT180-210-L	210 mm travel stage with linear motor and integral limits
ANT180-260-L	260 mm travel stage with linear motor and integral limits
ANT180-360-L	360 mm travel stage with linear motor and integral limits
Encoder Options	
-LTAS	Standard accuracy amplified sine encoder
-LTX50	Linear encoder - 0.1 um line driver output
-LNAS	High accuracy amplified sine encoder
Cable Management Options (for multi-axis systems)	
-XY	XY CMS option- to be ordered as X-Axis
-XY-AIR	XY CMS option with customer air line- to be ordered as X-Axis
-XYZ	XYZ CMS option- to be ordered as X-Axis
-XYZ-AIR	XYZ CMS option with customer air line- to be ordered as X-Axis
-Y	XY CMS option- to be ordered as Y-Axis
-Y-AIR	XY CMS option with customer air line- to be ordered as Y-Axis
-YZ	XYZ CMS option- to be ordered as Y-Axis
-YZ-AIR	XYZ CMS option with customer air line- to be ordered as Y-Axis

1.2. Dimensions



STAGE MODEL	A = STAGE LENGTH	B = NOMINAL TRAVEL	C = HARDSTOP TRAVEL	D = MOUNTING PATTERN LENGTH (mm [in])
ANT180-160-L	325	160	174	-
ANT180-210-L	375	210	224	225 [9.0]
ANT180-260-L	450	260	274	275 [11.0]
ANT180-360-L	575	360	374	350 [14.0]

DIMENSIONS: MILLIMETERS

Figure 1-2: ANT180-L Dimensions

1.3. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and damage to the equipment.

This manual and any additional instructions included with the stage should be retained for the lifetime of the stage.

	To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.
	To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the stage is connected to a power source.
	To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.
	Moving parts of the stage can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.
	Improper use of the stage can cause damage, shock, injury, or death. Read and understand this manual before operating the stage.
	If the stage is used in a manner not specified by the manufacturer, the protection provided by the stage can be impaired.
	Stage cables can pose a tripping hazard. Securely mount and position all stage cables to avoid potential hazards.

	Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.
	The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
	Use care when moving the stage. Manually lifting or transporting stages can result in injury.
	Only trained personnel should operate, inspect, and maintain the stage.
	This stage is intended for light industrial manufacturing or laboratory use. Use of the stage for unintended applications can result in injury and damage to the equipment.
	Before using this stage, perform an operator risk assessment to determine the needed safety requirements.

1.4. EC Declaration of Incorporation

Manufactorer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:
Aerotech, Inc. ANT180-L Stage
is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:
EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
Safety of machinery - Electrical equipment of machines - Part 1: General requirements
and further more declares that
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: April 15, 2011

Chapter 2: Installation

This chapter describes the installation procedure for the ANT180-L stage, including handling the stage properly, preparing the mounting surface to accept the stage, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.

Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. Use compressed nitrogen or clean, dry air to remove any dust or debris that has collected during shipping. Visually inspect the stage for damage. If any damage has occurred during shipping report it immediately. Remove stage shipping brackets. Set the stage on a smooth, flat, and clean surface. This is a simple, yet very important step in maintaining the integrity of the stage.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference.

Improper stage handling could adversely affect the stage's performance. Therefore, use care when moving the stage. Manually lifting or transporting stages can result in injury.

Lift the stage only by the base.

2.2. Shipping Bracket

Aerotech provides a shipping bracket to prevent unwanted stage motion and potential damage from occurring during shipment or transport. The bracket is red anodized aluminum, and it must be removed from the stage before it can operate. Figure 2-1 depicts the shipping bracket as it is used to constrain an ANT180-L stage.

Figure 2-1: Shipping Bracket Used on ANT180-L

NOTE: After removing the shipping bracket, you should retain it for future use. In the event the stage requires service at the factory, the shipping bracket should be reattached to ensure the stage ships safely.

2.3. Preparing the Mounting Surface

The mounting surface should be flat to 5 µm and have adequate stiffness in order to achieve the maximum performance from the ANT180-L. When an ANT180-L series stage is mounted to a warped surface, the stage can be distorted as the mounting screws are tightened (see Figure 2-2). Any distortion will decrease the overall accuracy of the stage. Adjustments to the mounting surface must be done before the stage is secured.

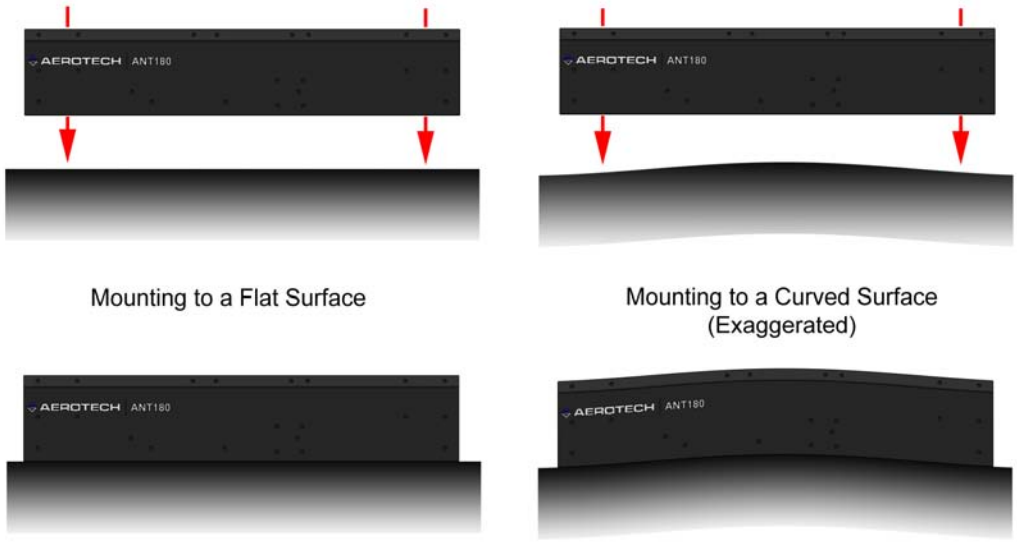


Figure 2-2: Mounting to a Flat Surface

NOTE: To maintain accuracy, the mounting surface should be flat within 5 µm over the entire stage footprint.

NOTE: The stage base is precision machined and verified for flatness prior to stage assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the stage base. Shimming should be avoided if possible.

2.4. Securing the Stage to the Mounting Surface

The ANT180-L stage is designed to be mounted using either M6 or ¼-20 socket head cap screws (SHCS) on standard Metric or English hole patterns, respectively. ANT180-160-L stages mount using four SHCS while all stages of longer travel mount with eight SHCS. Figure 2-3 shows the location of the mounting holes. Although access holes are provided through the carriage, it may be necessary to remove the stage end covers to help guide the mounting hardware into the correct counterbored hole. Refer to Figure 2-4 for the location of the end covers and mounting hardware. Holes are provided in the carriage tabletop to allow access to these holes when the carriage is moved to both ends of travel. Use 25 mm or 1" long screws to achieve 2x diameter thread engagement. Torque the mounting screws to 5.4 N*m (4 ft*lb).

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

NOTE: Mounting the stage requires passing the screws near the magnetic tracks mounted to the carriage. Use caution when mounting with magnetic hardware, or use non-magnetic hardware that will not be attracted to the tracks.

NOTE: Do not attempt to manually move the stage if it is connected to a power source.

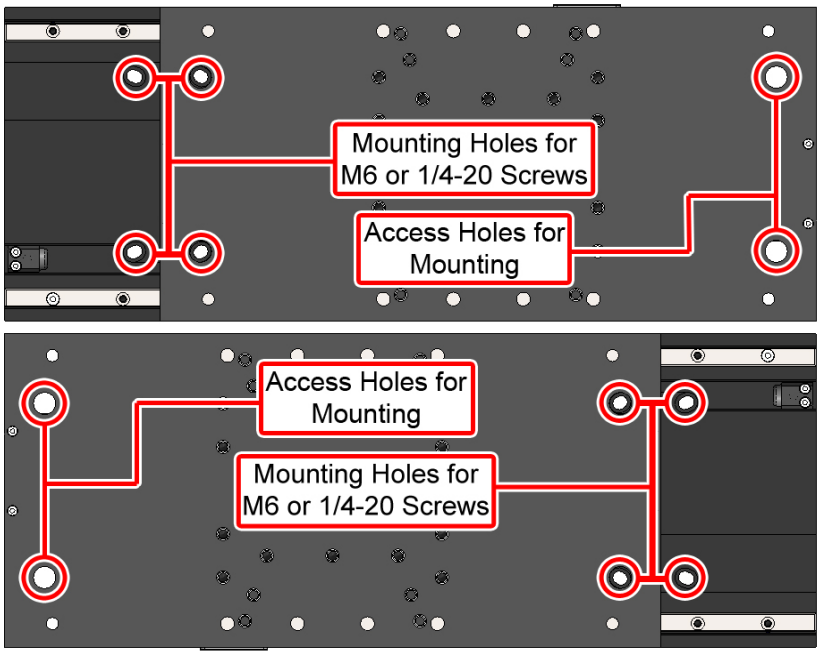

Mounting Holes for M6 or 1/4-20 Screws
Access Holes for Mounting
Access Holes for Mounting
Mounting Holes for M6 or 1/4-20 Screws

Figure 2-3: Mounting Hole Locations

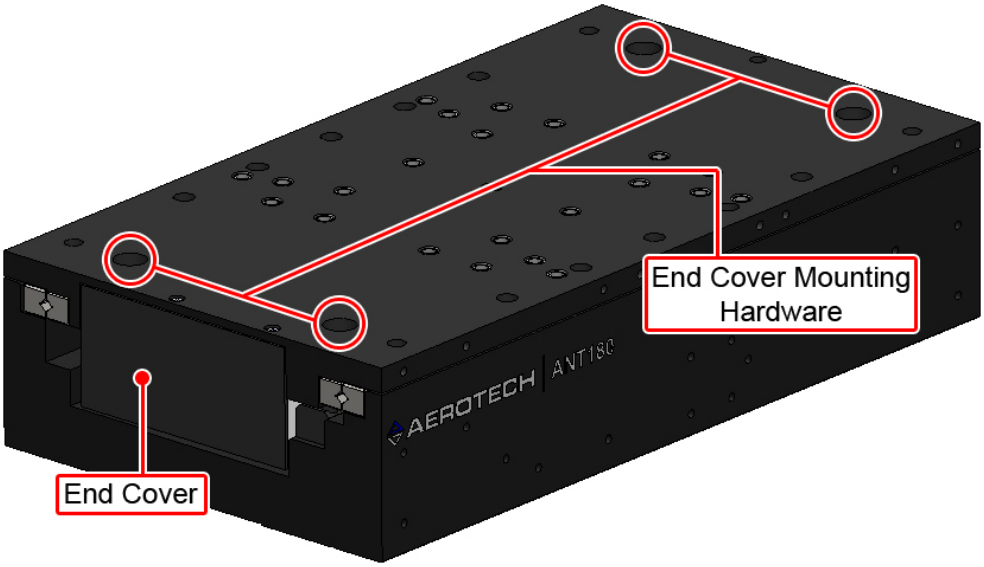


Figure 2-4: End Cover Removal

2.5. Attaching the Payload to the Stage

To prevent damage to the stage or parts, test the operation of the stage before any payload is mounted to the stage tabletop. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference.

For information on electrical connections, refer to the Electrical Installation section later in this chapter, the documentation of the motion control system delivered with the stage, and the wiring drawings in Chapter 3: Operating Specifications.

The payload must be flat, rigid and comparable to the stage in quality.

NOTE: For valid accuracies, the mounting interface should be flat within 1 µm per 50 mm.

Refer to Section 3.4. for information on cantilevered loads and load positioning.

NOTE: Do not attach a payload to the stage table with screws that are too long. Mounting screws should not project more than 7 mm (.276") into the stage table top.

2.6. Electrical Installation

Electrical installation requirements will vary depending on stage options. Installation instructions in this section are for stages equipped with standard Aerotech linear motors intended for use with an Aerotech motion control system. Contact Aerotech for further information regarding stages that are otherwise configured.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ANT180-L series stage is part of a complete Aerotech motion control system, setup involves connecting a stage and motor combination to the appropriate drive chassis with the cables provided. Connect the provided cables to the motor and encoder connectors on the stage (the number and location of the connectors can vary depending on the options purchased). Labels on the drive indicate the appropriate connections. Refer to your drive manuals and documentation for additional installation and operation information. In some cases, if the system is uniquely configured, a drawing showing system interconnects is supplied.

An integral linear motor comes mounted to all ANT180-L stages. The electrical wiring from the motor and encoder are integrated into two main connectors at the factory. Refer to Section 3.6. for standard motor wiring and connector pin outputs.

Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage may result.

The stage's protective ground is integrated into the motor and encoder connector. If you are using cables other than those provided by Aerotech, you must connect the pin listed as the ground in Section 3.6. to a ground connection.

Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the stage. This chapter provides information on ideal environmental and operating conditions. Also included are instructions for estimating load capability given various loadings.

3.1. Environmental Specifications

The environmental specifications for the ANT180-L are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C ±2° C (68° F ±4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect stage and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The ANT180-L stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Accuracy and Temperature Effects

The accuracy specification of ANT180-L series stages is measured at the center of travel 25 mm above the tabletop with the stage in a horizontal position. The stage is assumed to be fully supported by a mounting surface meeting or exceeding the specification in Section 2.3.

Extreme temperature changes could cause a decrease in performance or permanent damage to the stage. Aerotech stages are designed for and built in a 20°C (68°F) environment. Any deviation from standard operating temperature will affect stage accuracy. The severity of temperature effects on all stage specifications depends on many different environmental conditions, including how the stage is mounted. Contact the factory for more details.

The thermal expansion coefficient of the encoder scale depends on the option purchased. For LT stages, this value is 3.25 ppm/°C. For LN stages, this value is 7.5 ppm/°C. Travel will increase or decrease at this rate as the encoder scale temperature deviates from 20°C (68°F).

3.3. Basic Specifications

Basic ANT180-L series positioning stage specifications are shown in Table 3-2. Resolution is dependent on encoder resolution and controller interpolation. All ANT180-L travels are equipped with a BML-142-A linear motor as standard. Specifications for the BLM-142-A motor are given in Table 3-3.

Table 3-2: ANT180-L Series Specifications

Mechanical Specifications			ANT180-160-L	ANT180-210-L	ANT180-260-L	ANT180-360-L
Travel			160 mm	210 mm	260 mm	360 mm
Accuracy(1)(4)	LN	Plus	± 150 nm	± 150 nm	± 200 nm	± 200 nm
		Standard	±2.0 µm	± 2.5 µm	± 3.0 µm	± 3.5 µm
	LT	Plus	± 300 nm	± 300 nm	± 350 nm	± 350 nm
		Standard	±4.0 µm	±5.0 µm	±6.0 µm	±7.0 µm
Resolution	LN		1 nm	1 nm	1 nm	1 nm
	LT		3 nm	3 nm	3 nm	3 nm
Repeatability(1)(3) (Bi-Directional)	LN		± 100 nm	± 100 nm	± 125 nm	± 125 nm
	LT		± 150 nm	± 150 nm	± 175 nm	± 175 nm
Straightness(1)			±1.0 µm	±1.25 µm	±1.5 µm	±1.75 µm
Flatness(1)			±1.0 µm	±1.25 µm	±1.5 µm	±1.75 µm
Pitch			14 arc sec	14 arc sec	16 arc sec	16 arc sec
Roll			14 arc sec	14 arc sec	16 arc sec	16 arc sec
Yaw			10 arc sec	10 arc sec	12 arc sec	12 arc sec
Maximum Speed			500 mm/sec	500 mm/sec	500 mm/sec	500 mm/sec
Maximum Acceleration			2 g - 20 m/s² (no Load)			
Speed Stability			See graph for typical performance			
Settling Time			See graph for typical performance			
Maximum Force (Continuous)			110.5 N	110.5 N	110.5 N	110.5 N
Load Capacity(2)	Horizontal		30 kg	30 kg	30 kg	30 kg
	Side		20 kg	20 kg	20 kg	20 kg
Moving Mass			6.6 kg	7.8 kg	9.2 kg	11.7 kg
Stage Mass			12.8 kg	14.9	17.6 kg	22.4 kg
Material			Aluminum Body/Black Hardcoat Finish			
MTBF (Mean Time Between Failure)			30,000 hours			

(1) Certified with each stage

(2) Axis orientation for on-axis loading is listed.

(3) Specifications are for single-axis systems measured 25mm above the table top. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

(4) -PLUS requires the use of an Aerotech controller.

(5) Specifications are LNAS and LTAS only. Consult factory for specifications regarding LTX50 option.

Table 3-3: BLM-142-A Motor Specifications

	Units	Specifications
Performance Specifications(1,5)		
Continuous Force (No cooling)(2)	N (lb)	173.2 (38.9)
Peak Force(3)	N (lb)	110.5 (24.8)
Electrical Specifications(5)		
BEMF Constant (Line-Line, Max)	V/m/s (V/in/s)	40.96 (1.04)
Continuous Current (No cooling)(2)	Amp_{pk} (Amp_{rms})	3.10 (2.19)
Peak Current, Stall(3)	Amp_{pk} (Amp_{rms})	19.44 (13.75)
Force Constant, Sine Drive(4)	N/Amp_{pk} (lb/Amp_{pk})	35.63 (8.01)
	N/Amp_{rms} (lb/Amp_{rms})	50.39 (11.33)
Motor Constant(2,4)	N/√W (lb/√W)	10.53 (2.37)
Resistance, 25°C (Line-Line)	ohms	10.90
Inductance (Line-Line)	mH	8.70
Thermal Resistance (No cooling)	°C/W	0.91
Maxumum Bus Voltage	VDC	340
Mechanical Specifications		
Magnetic Pole Pitch	mm (in)	30.48 (1.20)

(1) Performance is dependent upon heat sink configuration, system cooling conditions, and ambitent temperature.

(2) Values shown @ 100 °C rise above 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink.

(3) Peak force assumes correct rms current; consult Aerotech.

(4) Force constant and motor constant specified at stall.

(5) All performance and electrical specifications +/-10%.

(6) Maximum winding temperature is 125 °C.

(7) Ambient operating temperature range 0 °C - 25 °C. Consult Aerotech for performance in elevated ambient temperatures.

3.4. Load Capability

It is recommended that application loads be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). With the stage lying flat (horizontal) and the application load vertically applied and symmetrically distributed, the maximum vertical load carrying capacity of ANT180-L stages is 30 kg. If cantilevered loads are applied, refer to Figure 3-1 to find the loading condition, then Figure 3-2 through Figure 3-5 to find the maximum allowable load.

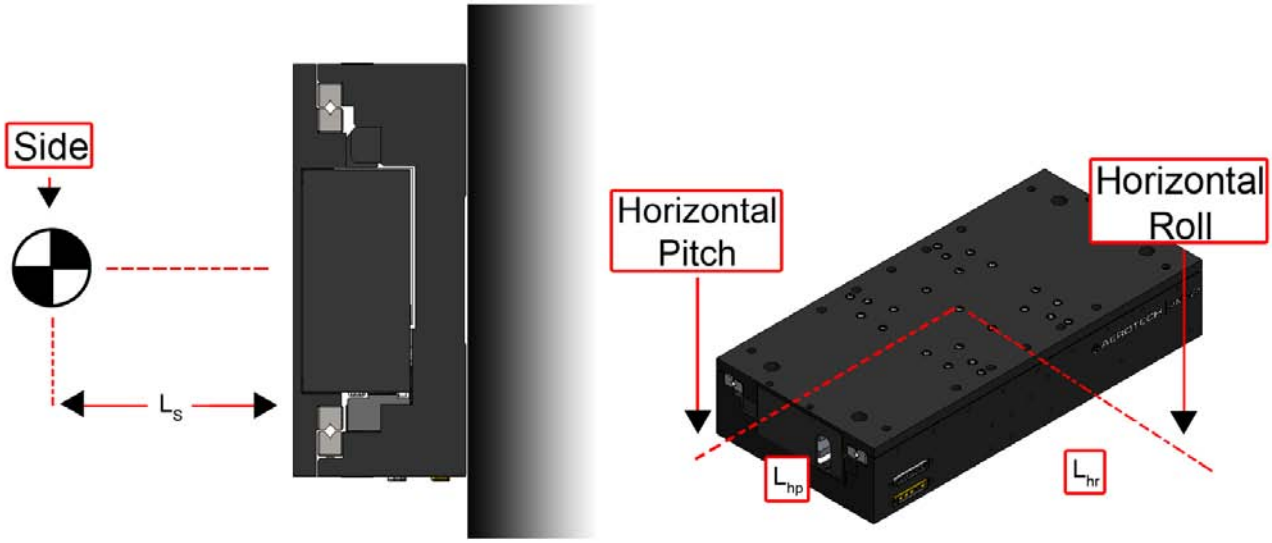


Figure 3-1: Stage Loading Conditions

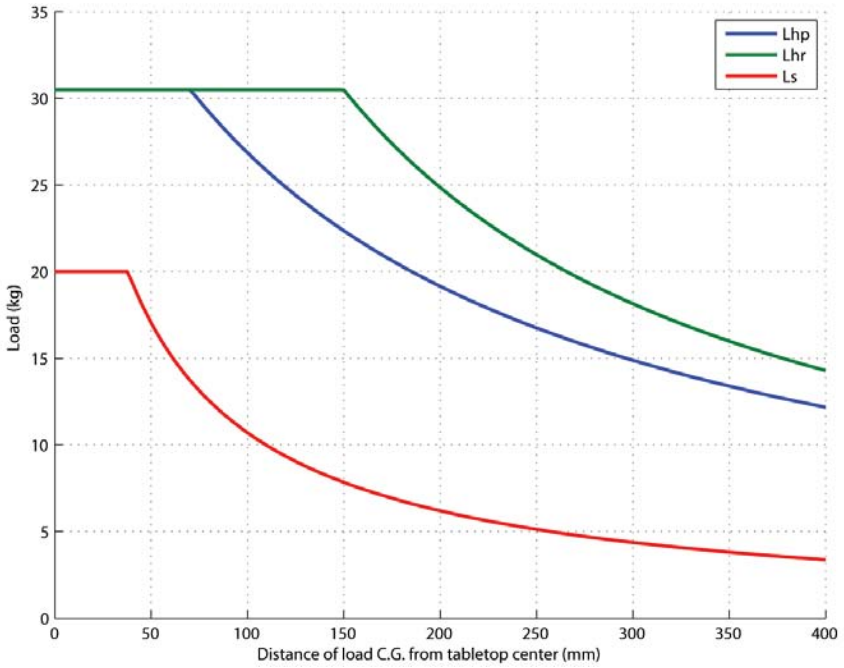


Figure 3-2: Load Capability of ANT180-160-L Stages

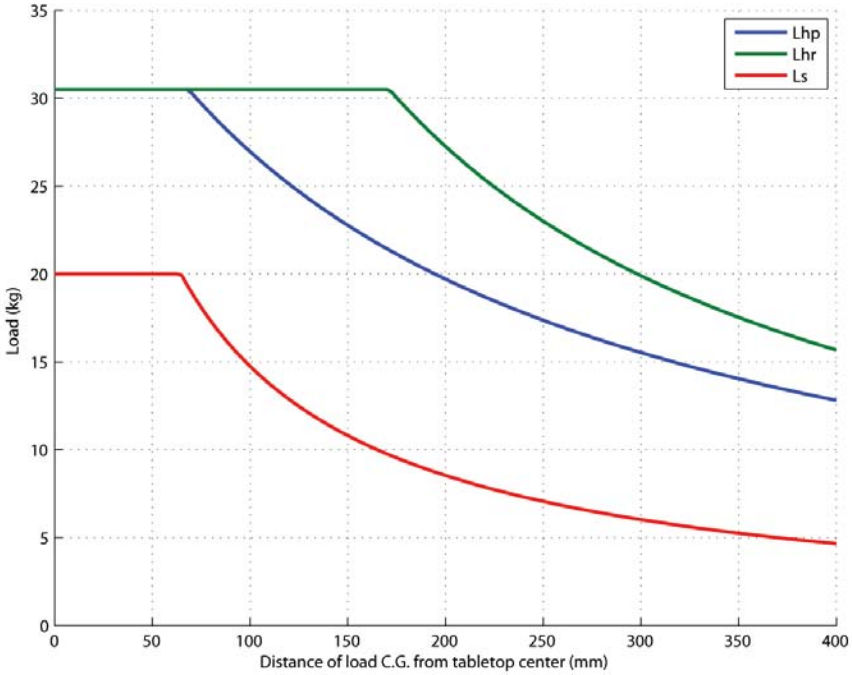


Figure 3-3: Load Capability of ANT180-210-L Stages

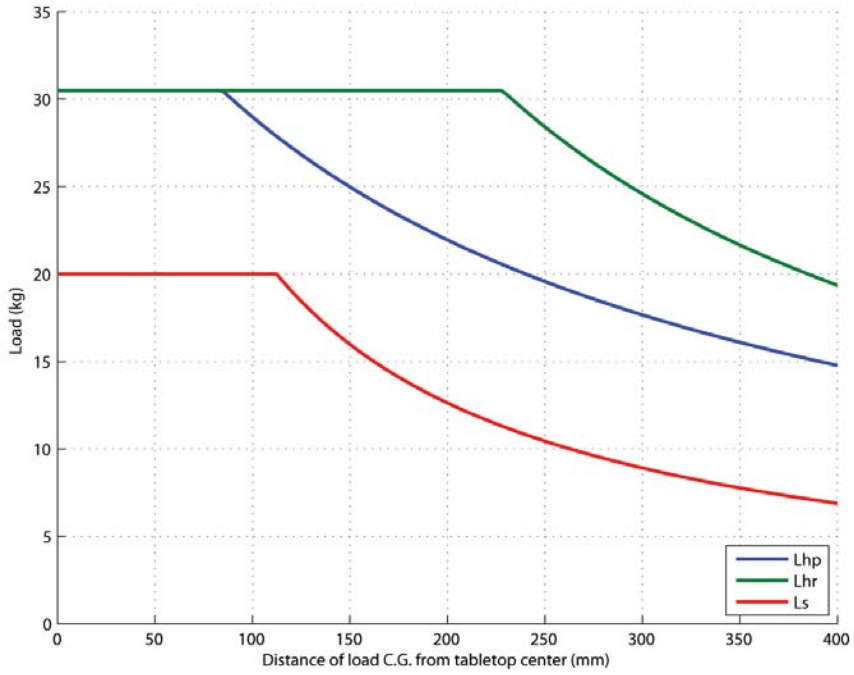


Figure 3-4: Load Capability of ANT180-260-L Stages

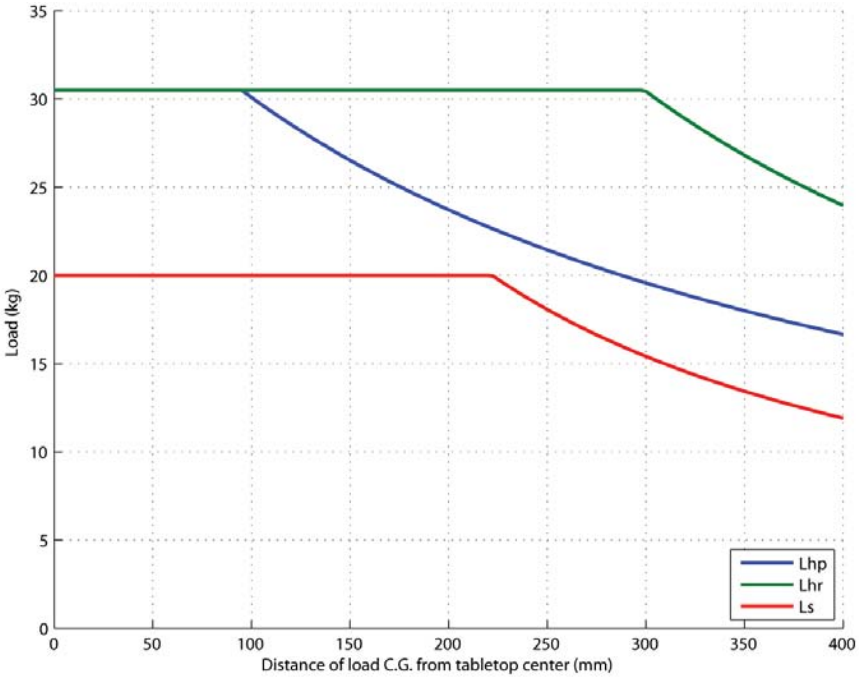


Figure 3-5: Load Capability of ANT180-360-L Stages

3.5. Limit Switches

ANT180-L series stages are provided with two EOT (end of travel) limit switches. The limit switches signal when the stage has reached its maximum useable travel distance in both directions.

3.5.1. Limit Switch Wiring

Limit switches are open-collector, TTL–compatible devices that change output states when the stage approaches its maximum travel distance. Since they are open-collector devices, they may be interfaced to 24 Volt logic inputs.

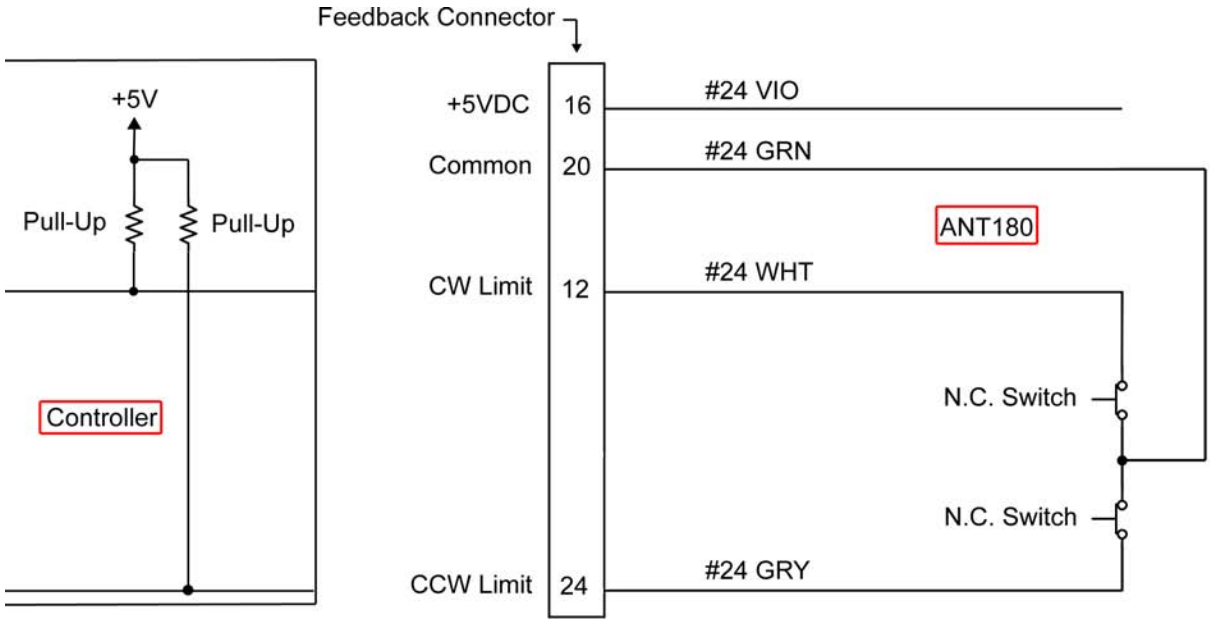


Figure 3-6: ANT180-L Series Limit Switch Wiring

The input to the controller is seen as a logic 0 (typical 0.4V @ 12.8 mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor, on the controller, causes a logic 1 (typically 4.8-5 V) to be seen by the controller input. See Figure 3-6 for a diagram of limit switch wiring.

3.5.2. Limit Operation with the -LNAS Encoder Option

The limit signals provided by the encoder with the -LNAS encoder option are nonstandard. These two signals do not directly indicate end of travel limits. There are two TTL compatible open-collector signals, capable of driving 8mA. Table 3-4 describes these two signals.

Table 3-4: -LNAS Encoder Option Limit Signals

Signal	Internal Encoder Signal Name	Description
CCW/-LMT	L	EOT Limit indicator (non-directional)
CW/+LMT	H	Stage Directional Signal

As shown in Figure 3-7, if the CCW/-LMT signal is true, the CW/+LMT signal will indicate which end of travel limit is active.

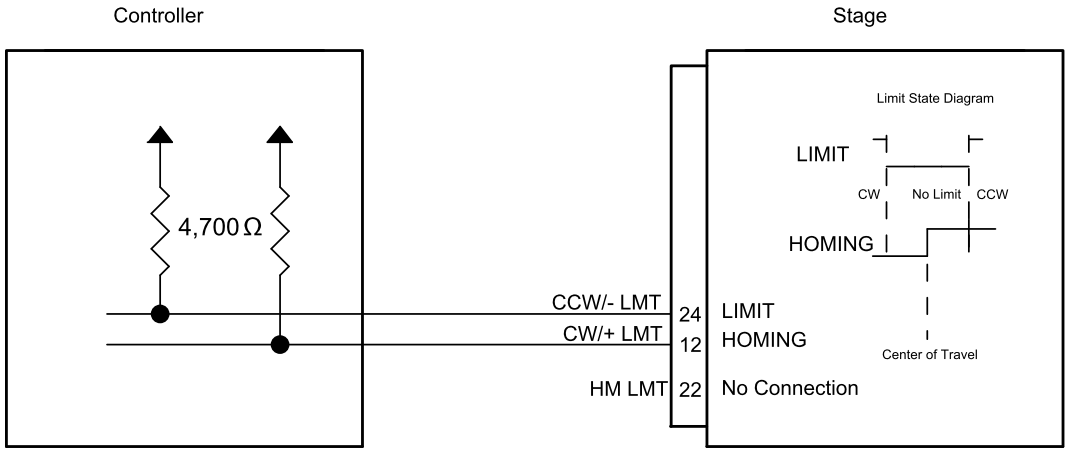
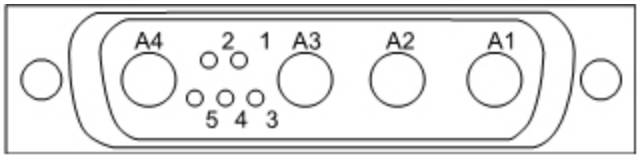


Figure 3-7: -LNAS Encoder Option Limit Wiring

3.6. Standard Wiring

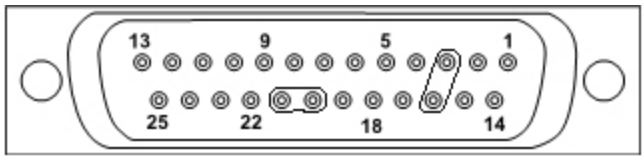
ANT180-L stages come equipped with motor and feedback connectors completely wired and integrated into the stage. For reference, connector pin assignments and general wiring information are given in the following tables. Pin assignments are defined in Table 3-7.

Table 3-5: Motor Connector Pin Assignments



Pin	Description	Pin	Description
A1	MTR ØA	3	RESERVED
A2	MTR ØB	4	RESERVED
A3	MTR ØC	5	RESERVED
1	MTR SHLD	A4	FRM GND
2	RESERVED		

Table 3-6: Feedback Connector Pin Assignments



Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	RESERVED	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR	20	LIMIT COMMON
8	RESERVED	21	ENCODER COMMON
9	RESERVED	22	RESERVED
10	HA	23	RESERVED
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

Table 3-7: Connector Wiring Pinout Descriptions

Pin Output	Description
+LMT	Active high signal indicating maximum travel produced by positive stage direction.
COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.
COS-N	Incremental encoder output. Compliment of cos.
-LMT	Active high signal indicating stage maximum travel produced by negative stage direction.
ENC +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
HA	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HB	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HC	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.
LMT +5v	+ 5 V supply input for optical limit switch boards. Typical requirement is 50 mA.
MKR	Marker. Incremental encoder output pulse given once per revolution. Typically used for home reference cycle.
MKR-N	Incremental encoder output; either the compliment of Marker with a line driven, TTL type encoder or 2.5 V DC bias level with amplified sine wave type encoder.
SIN	Sine. Incremental encoder output; either TTL line driven or amplified sign wave type signal.
SIN-N	Incremental encoder output. Compliment of sin.
THERM SW	Positive lead for motor thermistor (to motion controller).
MTR ØA	Motor Phase A.
MTR ØB	Motor Phase B.
MTR ØC	Motor Phase C.
+5V	+5V supply.
LMT COM	Common ground to limit switch.
SIG SHLD	Signal shield connection.
RESERVED	Not used.
SIG COM	Signal common.

3.7. Vacuum Operation

Aerotech can specially prepare the ANT180-L series stage for operation in vacuum environments. Aerotech offers two vacuum preparation options; one for low vacuum (for use in atmospheric pressures to 10^{-3} torr) and one for high vacuum (preparation for environments from 10^{-3} to 10^{-6} torr). As part of this preparation, attention to detail during modification, cleaning, and assembly results in stages with optimal performance in vacuum applications. Preparation techniques for stages that will operate in a vacuum include:

- Lubrication with vacuum–compatible lubricants
- Use of materials, fasteners, and coatings with vacuum outgas performance compatible with the level of vacuum specified
- For high vacuum stages, elimination of situations that may allow gases to become temporarily trapped during pump down
- Extensive cleaning prior to assembly in a clean environment and packaging in a special polyethylene bag

3.7.1. Special Guidelines

To ensure that the stage will continue to perform well in the vacuum environment, follow the guidelines listed below (in addition to standard handling, installation, and lubrication guidelines outlined earlier in this manual).

1. Do not remove the stage from the sealed bag until it is ready for use.
2. Always handle the stage in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the stage.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the stage.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum–compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of Braycote® 602EF grease or a substitute of equal quality.

Baking vacuum components between 100 and 125 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum surfaces and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 4: Maintenance

This chapter will cover information about intervals between lubrications, detail the lubrication and inspection process, and cover which lubricants are recommended for use.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in ANT180-L series stages depends on conditions such as duty cycle, speed, and the environment. Inspect the stage once per month until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the bearing surfaces. In general, lubricate stages operating in a clean environment annually, or every 500 km, whichever comes first. For stages operating under conditions involving excessive debris, lubrication every six months is recommended.

If the application process uses only a small portion of travel for most of the duty cycle, it is recommended that the stage be periodically driven through full travel to redistribute the lubrication in the bearings. The motor is completely non-contact and requires no lubrication.

4.2. Cleaning and Lubrication

4.2.1. Recommended Cleaning Solvents

For standard cross-roller bearings, Kluberplex BEM 34-132 grease is recommended.

For high-speed applications (i.e. near max speed at a duty cycle of 50%),frequent maintenance with standard lubricants is required.

If a solvent is necessary for cleaning the stage, use isopropyl alcohol.

4.2.2. Important Notes on Lubrication

When cleaning and/or lubricating components of the ANT180-L series stages:

1. Be sure to use a clean, dry, soft, lint–free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the cross-roller bearings for any damage or signs of wear.
3. In applications that have multiple stages bolted together to form multi-axis systems, the orthogonality may be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.
4. Because proper assembly and calibration can only be done at the factory or in the field by a qualified technician, do not further disassemble the stage. If the stage is disassembled then reassembled, a laser interferometer is required for post assembly verification to maintain warranties.

4.2.3. Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow. Before beginning lubrication, see Section 4.2.1. for recommended lubricants.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

1. Remove power to the stage.
2. Remove any accumulated dust or debris from the inside of the assembly.
3. Remove any dirty or dried lubricant from the v-channels of the linear bearing rails. Use a clean, lint-free cloth with a side-to-side motion. You can use a swab soaked in Isopropyl Alcohol to remove stubborn debris.
4. Apply a thin, continuous film of lubricant to the exposed v-channels of the bearing rails on both ends of the stage. A good quality, natural bristle artist's brush makes an excellent applicator. Do not use any applicator that could scratch or otherwise damage the v-channels.
5. Manually move the stage to the opposite end of travel. This will work the grease into the linear bearing guides. The stage table should move freely with little resistance.
6. Repeat steps 2 through 4 for any areas covered by the original table position.
7. Restore power to the stage; drive the stage table back to its original position to redistribute lubricants.

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

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Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA
15238-2897

Phone: (412) 963-7470

Fax: (412) 963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.02.00)

Section(s) Affected	General Information
Section 3.5.2.	Added section

Table B-2: Archived Changes

Revision	Section(s) Affected	General Information
1.01.00	Section 1.4.	Added section
1.01.00	Section 3.1.	Added section
1.01.00	Chapter 2: Installation, Section 2.1. , Section 2.4. , Section 2.6. , and Section 1.3.	Added safety information and warnings
1.01.00	Section 3.6.	Added note about current requirements of motor and ground wires
1.00.00	--	New manual

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Reader's Comments

ANT180-L Series Stage Manual **P/N: EDS153, April 15, 2011** **Revision 1.02.00** Please answer the questions below and add any suggestions for improving this document.	

Is the manual:	Yes	No
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

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